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NSERC Contact

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A Much-Needed Boost for S&T

Editorial by Tom Brzustowski

There is very good news in the federal budget. NSERC's budget will rise from $434 million this fiscal year to $494 million on April 1, 1998. What follows is the text of a letter that I have sent to the Prime Minister, the Minister of Finance, the Minister of Industry, the Secretary of State (Science, Research and Development), the members of the Government Caucus on Postsecondary Education,and the appropriate deputy ministers and senior officials, expressing my appreciation for their support of Canadian university research.

Dear Prime Minister:

I am writing to express my most sincere appreciation for the budget. The increase in funding for NSERC is a welcome signal of support and a much-needed boost for Canada's capabilities in science and technology.

This commitment is an extraordinarily important decision by the Government of Canada. I know that it was not an

easy decision to make, in light of all the other pressures. But with this decision, the government has made the statement that support for university research and the advanced training of many of our brightest young people is a strategic investment in the nation's prosperity and in the well-being of Canadians.

This public investment is unique. It is the only one that provides both short-term and long-term returns, in many forms. It immediately provides income for more than 12,000 very talented Canadians, most of them young people. It supports project research in partnership with our industry to solve today's industrial problems, promoting product and process innovation. In this way, it creates sustainable high-quality jobs, again many of them for young people. It supports world-class basic research that gives Canada access to all the world's research and builds up the stock of ideas for future radical innovations in all sectors of our economy. And it supports learning that develops the long-term capability of today's young Canadians to find new ways of maintaining our prosperity and high quality of life as the world continues to change.

This budget moves Canada in the right direction. It begins the strategic repositioning of NSERC's budget so that our research community might continue to serve the nation effectively in an economic environment that has changed profoundly since the council was created twenty years ago. It is a very encouraging first step.

Canada's young people will be very encouraged by the increased allocation for university research. It will help many of them directly to pursue postgraduate studies in research and to develop their talents to the full. And the government's increased emphasis on the importance of science and technology holds out the promise that our young scientists and engineers with advanced training will find satisfying careers in their own country, and be able to contribute to the nation that invested in their education.

Once again, please accept my most sincere appreciation for the budget. Your personal understanding of the importance of Canadian university research in science and engineering, your public expressions of support for it, and your efforts to provide it with adequate resources are all greatly appreciated.

Many thanks.

Most sincerely,

We should have no doubt that the government was faced with very hard choices in setting the budget, and that it was not an easy decision to increase the support for university research. The decision to start building up NSERC's budget is extremely important. It

enables NSERC to begin addressing some of the most pressing issues in Canada's capacity for NSE research. It is a very good start, but more will have to be done in the coming years to build that capacity up to a competitive world-class level, and the research community must work hard and persistently to make the case for it.

For this reason, I hope that members of the research community will join me in thanking the PM and the ministers for the decisions in the 1998-99 budget by writing their own individual letters of appreciation, and writing them promptly. I am sure that the ministers would be interested to hear about the letter writer's own research, and about the impact of the support received through NSERC.

As this is being written, NSERC staff are already at work analyzing the federal budget in detail. We will be preparing options for Council to consider when it revises NSERC's own 1998-99 budget in light of the new allocation.

1998 Steacie Fellowship and Doctoral Prize Winners Announced

NSERC president Tom Brzustowski recently announced the 1998 winners of the NSERC Doctoral Prizes and theE.W.R. Steacie Memorial Fellowships.

Steacie Fellows

The E.W.R. Steacie Memorial Fellowship is given to university researchers who are capturing international attention for outstanding scientific or engineering achievement.

NSERC provides their university with the full amount of their salary for up to two years, and the fellows are free to pursue their innovative research full-time, and are also eligible for other research funding from the Council.

The winners of the 1998 E.W.R. Steacie Fellowships are:

Dr. Sara Iverson, a biology professor at Dalhousie University, who has conducted outstanding basic research on the physiological biochemistry of milk production in mammals and the role of fat in animal reproduction and survival. She has also pioneered a major new interdisciplinary field that is having wide impact in ecology and wildlife conservation.

The researcher has established Canada as the world leader in developing the use of fatty acid 'signatures' to study animal feeding and foraging in the wild. This powerful technique involves detection of the telltale traces of prey fatty acids in the fat stores of predators. Through it the animal becomes the data logger, recording information on its diet and foraging patterns. This data, in turn, can reveal important information on changes in prey species and their

abundance, as well as offer valuable insight into the health of the ecosystem. The research is of particular value to Canada, which has many difficult-to-study marine mammals, as well as unanswered questions concerning the status and vulnerability of fish stocks.

Dr. Iverson has assumed a leading position in a rapidly expanding field and is a role model for her undergraduate classes and her graduate research students, the majority of whom are women. The NSERC Steacie Fellowship will permit her to expand her laboratory research as well as her field studies on Sable Island.

Dr. Jonathan Schaeffer, a University of Alberta computer scientist, whose invention of the checker-playing program Chinook was a milestone in artificial intelligence. The study of games has been at the centre of artificial intelligence research since the field came into existence in the 1950s, and has become a major tool helping computers solve increasingly difficult and complex problems. According to US computer scientist Dr. Richard E. Korf, games provide such a fertile and profound laboratory for the study of intelligent behaviour, because they are simpler than many real-world problems and the available information, the available actions, their outcomes, and the overall goals are well-defined. This fundamental simplification, says Dr. Korf, is the key to progress in most areas of science and engineering.

Dr. Schaeffer is widely recognized for pioneering the use of parallel computing in games. In addition, he has made significant contributions to the theory of search. Algorithms based on his research can be used to simplify very complicated sets of research instructions and arrive at answers. This advance has been widely applied both in artificial intelligence research and computer software.

The Steacie Fellowship will permit him to turn his efforts to poker and Sokoban - two games largely ignored by artificial intelligence researchers but whichoffer the prospect of insight into problems of planning, risk and uncertainty.

McGill University physics professor **Dr. Louis Taillefer**, an international leader in one of the hottest areas of modern science: the race to describe and understand the physical properties of unconventional superconductors. Some of these novel materials lose their resistance to electricity at much higher temperatures than other superconductors, which must be chilled to close to absolute zero and thus are impractical for most applications. Suggested uses for the new materials range from heat-free computer components to efficient and powerful magnets, and "wires" that allow zero-cost electrical transmission.

Much of Dr. Taillefer's success can be attributed to his first-rate abilities as an experimental physicist, in particular his extraordinary talent for producing superconductor crystals of the highest purity and perfection. His assistance to young researchers is equally impressive. He attracts outstanding graduate students and research associates; all of his Ph.D. students have been awarded NSERC scholarships. While most of his work is carried out in the low temperature facilities that he has built at McGill, several projects

involve international collaborations at major neutron beam facilities and synchrotrons. He has been an Associate in the Superconductivity Program of the Canadian Institute for Advanced Research since 1992.

The Steacie Fellowship will permit him to explore a number of avenues opened up by his recent work on heat transport. He also hopes to pioneer ultrasound spectroscopy as a new technique to probe the electronic properties of high temperature superconductors.

University of British Columbia mathematics professor **Dr. Michael Ward**, who is leading an international renaissance in applied mathematics. Dr. Ward has explored this field in remarkable depth, analyzing and developing new models that are being used in areas such as materials science, biology, combustion, fluid mechanics and predicting the performance of semiconductor devices.

While Dr. Ward has made his mark internationally in classical applied mathematics and particularly in asymptotic analysis, he has also made major theoretical advances in the theory of meta-stability. Metastable processes influence outcomes in many physical systems, but they are the turtles of the phenomenological universe, taking so long to develop that they are impossible to track numerically. Dr. Ward's methods for analyzing them have evolved into a new mathematical technique in wide use.

With his Steacie Fellowship, he plans to investigate other classes of very practical diffusion problems including pattern formation problems in biological modeling, the vibrations of thin plates in which part of the plate has been cut out, changes in chemical reactions that occur around a defect on a reacting surface, the formation of hot spots in heated ceramics, and the diffusion of oxygen through small capillaries to muscle cells.

Doctoral Prize Winners

In announcing the Doctoral Prize winners, Dr. Brzustowski said "These four young people have made an outstanding start to their research careers. Their achievements exemplify the high quality of research in Canadian universities, and the value of research and innovation for the country's future."

The following winners will each receive a silver medal and $5,000:

Dr. Neil A. Duncan, Department of Mechanical Engineering, McGill University. As many as one in 20 young women are faced with the unsettling diagnosis of scoliosis - an abnormal curvature of the spine. In an outstanding contribution to engineering mechanics, Dr. Duncan reveals that the progression and seriousness of the curvature are determined not by the disease's suspected genetic cause but by the mechanics of body structure and the person's growth pattern. His research shows why women are more vulnerable than men and suggests screening methods to identify scoliosis patients who will require treatment and those who will not. Dr. Duncan has been engaged as an assistant professor in the

Department of Civil Engineering of the University of Calgary.

Dr. Janet Elliott, Department of Mechanical Engineering, University of Toronto. Dr. Elliott's thesis has been described as a landmark in the prediction of how gases interact with metal surfaces and a major step toward establishing a general theory of molecular kinetics for surface scientists. Although there is a wealth of empirical knowledge of gas-solid interactions, until her study there had been a dearth of theoretical insight into the phenomena. Dr. Elliott's findings are expected to speed the development of new corrosion and fracture-resistant materials, as well as improved catalysts and metal oxide semiconductors. Dr. Elliott is now an assistant professor in the Department of Chemical and Materials Engineering at the University of Alberta.

Dr. Yingfu Li, Department of Chemistry, Simon Fraser University. In his thesis project, Dr. Li isolated a revolutionary and very small catalytic DNA enzyme. This discovery, reported in top international scientific journals, has given an exciting thrust to the brand new field of DNA catalysis. DNA enzymes are expected to become powerful tools in a wide range of pharmaceutical and biotechnological processes. Not only was Dr. Li able to isolate his enzyme and demonstrate its effectiveness, he was also able to characterize its properties in what his thesis supervisor describes as astonishing depth. Dr. Li is now a postdoctoral fellow in the Department of Molecular, Cellular and Developmental Biology, Yale University.

Dr. Shawn J. Marshall, Department of Earth and Ocean Sciences, University of British Columbia. During Ice Age surges, fast flowing ice streams delivered huge volumes of ice to the oceans, influencing ocean levels and global climate. In a remarkable theoretical study, Dr. Marshall has linked these catastrophic events to intrinsic instability of the ice motion processes. His rigorous computer simulation of these surges - a world first - has given new insight into the behaviour and stability of ice sheets (of which the Antarctic Sheet is the largest remaining) and a new test for global climate models. Dr. Marshall continues his research as a postdoctoral fellow at UBC.

The winner of NSERC's highest honour, the Canada Gold Medal for Science and Engineering, will be announced on April 27.

His Excellency The Right Honourable Roméo LeBlanc, Governor General of Canada, will present all of the awards that same day in a ceremony at Rideau Hall in Ottawa.

For more information on all the winners, visit NSERC's Web site (http://www.nserc.ca/news1.htm).

NSERC 20th Anniversary Update

NSERC moves out of its "teens" on May 1. That's the day the Council was set up twenty years ago, and we're planning to use the anniversary as a way of calling the attention of the public to the

importance of university research.

NSERC's 20th Anniversary Web Site

http://www.nserc.ca/misc/20/brochure.htm

During 1998 a new site will showcase some of NSERC's achievements over the last twenty years. It will illustrate how NSERC is relevant and important to the present and future prosperity of Canada. Visitors will find out how NSERC-funded groundbreaking research of twenty years ago is affecting them each and every day of their lives, from how they get to school or work, to how they do their work, to how they play. There will also be segments highlighting top scientists and engineers as well as a Knowledge game linked to Schoolnet. New items will be appearing each month.

The President's "Report to the Nation"

The centrepiece of the celebrations is the President's "Report to the Nation" series of speaking engagements. His speech, about the benefits of university-based research, will be given in more than seven cities across Canada.

Dr. Brzustowski kicked off the tour with an address to the Board of Trade of Greater Montreal at its breakfast meeting on February 11. Over ninety people from the business and the university communities turned out in the early morning to listen to Dr. Brzustowski speak on "Research, Young People, and the Canadian Economy."

When Contact went to press, Dr. Brzustowski had been booked to speak in six different locations in March and April alone (see list below).

Additional details on these and other speaking engagements in the series will be posted on our new 20th anniversary Web site as they become available, so be sure to visit it regularly.

March 16	**Calgary** Calgary Chamber of Commerce Chamber of Commerce Building 517 Centre Street South, 4th floor Time: 12:00 (noon) Phone: (403) 750-0400
March 17	**Edmonton** Edmonton Chamber of Commerce Crowne Plaza Chateau Lacombe Time: 12:00 (noon), reception begins at 11:30a.m. Phone: (403) 426-4620
March	**Toronto**

30 The Canadian Club of Toronto
The Ballroom, The Royal York Hotel
Time: 12:00 (noon)
Tickets: $35 members; $40 non-members;
$375 for table of 10
Reservations: (416) 364-5590
Information: Meg Connell, (416) 364-5591

April 1 **London**
London Chamber of Commerce
244 Pall Mall St. London
Time: 7:30 a.m.

April 16 **Vancouver**
Vancouver Board of Trade/SFU/BC Advanced Systems Institute co-sponsors
SFU at the Harbour Centre
Time: 7:30 a.m.

April 23 **Québec City**
Chambre de Commerce et d'industrie du Québec métropolitain
Location to be determined

NSERC's New Vice-President: Suzanne Fortier

Dr. Suzanne Fortier, a professor and Vice-Principal of Research at Queen's University, is NSERC's new Vice-President. She was elected by the Council at its meeting in October, and her appointment was recently ratified by the Governor-in-Council.

After obtaining her Ph.D. (crystallography) from McGill University in 1976, Dr. Fortier carried out postdoctoral research and worked as a Research Scientist at the Medical Foundation of Buffalo, Inc. for several years. She joined Queen's University as an assistant professor of chemistry in 1982, was promoted to associate professor in 1986 (with a cross-appointment in Computing and Information Science in 1992), and was appointed a full professor (in both departments) in 1993. In 1994, she also served as Acting Dean, School of Graduate Studies and Research, and since 1995, she has been Vice-Principal, Research.

Throughout her career, Dr. Fortier has served on many committees and boards, including several at NSERC. She is currently Chair of the Ontario Council on University Research, and a member of the boards of two Ontario Centres of Excellence. She is also a member of the R&D Advisory Board of Environment Canada, the Canadian Society for Chemistry, and the Canadian Society for Computational Studies of Intelligence.

In 1997, Dr. Fortier received the Clara Benson Award for distinguished contribution to chemistry by a woman, and the

Entrepreneurship Award (with J. Glasgow and E. Steeg), a Communications and Information Technology Ontario Innovation Award.

Do you know of an outstanding Canadian scientist or engineer?

A person whose career achievements are exceptional?

NSERC would like to recognize his or her vital contribution to Canadian research in the natural sciences and engineering.

How can you help?

Simply by nominating this researcher for one of Canada's highest honours the CANADA GOLD MEDAL FOR SCIENCE AND ENGINEERING before October 1, 1998.

Call us for more details at (613) 996-6266.

Visit our Web site at http://www.nserc.ca/misc/20/brochure.htm.

Eligible Students and Fellows to Receive Paid Parental Leave

Graduate students and postdoctoral fellows may now request a parental leave supplement if they meet the eligibility requirements. The new policy, which Council approved at its October 1997 meeting, applies to students and fellows who are the primary caregiver for a child within six months after thechild's birth or adoption.

On request, and if the organization or university where the award is being held grants parental leave, holders of NSERC Postgraduate Scholarship (PGS), Industrial Postgraduate Scholarship (IPGS) and Postdoctoral Fellowship (PDF) awards will be paid a supplement equivalent to their current stipend for the period of time they spend on parental leave, up to a maximum of four months. (Note that the option to defer or interrupt the scholarship or fellowship for up to 3 years for maternity or child rearing is still available.) Students and fellows paid out of NSERC grants will receive a supplement in the amount needed to support parental leave for a period of up to four months at their current rate of compensation.

The policy takes effect on April 1, 1998. The NSERC-supported parent of a child born or adopted after October 1, 1997, who plans to take parental leave on or after April 1, 1998, should contact NSERC as soon as possible to obtain the paid parental leave benefit.

Eligibility criteria

Neither the NSERC-supported parent nor the other parent may be eligible for full parental leave benefits from other sources.

Students or fellows paid out of NSERC grants must be registered for graduate or postdoctoral studies and receive their compensation in the form of a scholarship or bursary, or receive their compensation in the form of a salary provided this salary is for less than 700 hours of work in the previous year.

For more information NSERC PGS, IPGS and PDF holders should contact the Scholarships and Fellowships division by e-mail at schol@nserc.ca.

Students and fellows paid out of NSERC grants should contact the Dean of Graduate Studies at their university or the Council's Awards Administration Team by e-mail at cssdfin@nserc.ca.

Revisiting NSERC's Strategy

Council decided at its January meeting to set up a task force to study the research environment and recommend ways to ensure that NSERC remains relevant. NSERC's last strategy, Partnerships in knowledge, was published in 1994. Since then the research environment has undergone significant change: among other things, university funding from the provinces has been cut back, tuition fees have increased sharply, and the Canada Foundation for Innovation has been launched.

The membership of the task force will be decided by Council at its June 1998 meeting. NSERC's Policy and International Relations division will be acting as the task force's secretariat.

Partners in Canadian Research

This year, 27 Canadian research projects received more than $2 million when NSERC's partners announced the results of their 1997 Research Partnership Agreements competitions. This Agreements program is jointly sponsored by NSERC and its four federal government partners.

The awards provide a real opportunity for many of our country's leading researchers to work in collaboration with industry and the partner department or agency. Program details are available on NSERC's Web site. Here is a sampling of the projects that won the 1997 awards.

Department of National Defence: Flying in the Right Direction

Aeronautical design engineers don't have a package that would allow them to develop methods to control flight direction confidently, and Professor Alain A. De Champlain of Laval University's Department of Mechanical Engineering aims to provide them with such a tool.

Professor De Champlain works with jet vane thrust vector control systems. With researchers at the Defence Research Establishment Valcartier and Allied Signal, he is studying how the placement of vanes or secondary jets in the exhaust plumes of propulsive devices, such as rocket motors, affects the direction they take. The research team is analyzing the properties of various composite materials and testing them in real exhaust plumes to measure their resistance to erosion and their abilities to transfer heat.

The team's findings will be translated into mathematical heat transfer and erosion models that will be used, in turn, in a computational fluid dynamics (CFD) package for design engineers, giving them a means to predict flight direction. The project will also verify the models using a high-speed camera with the particle image velocimetry technique, a type of detailed stop-motion photography, to depict visually the flow field in the various exhaust plumes.

National Research Council of Canada: Step-by-Step Robotics

Professor Kamal K. Gupta, of the School of Engineering Science at Simon Fraser University, plans to help robots take a giant, collision-free step. With his colleagues Professor John C. Dill, also of Simon Fraser University, Michael A. Greenspan of the Institute for Information Technology at the NRC and International Submarine Engineering Ltd., Professor Gupta aims to provide manipulator robots with the means to sense obstacles and plan how to move so they can avoid obstacles on their own. Such robots will be programmed in terms of tasks rather than the tedious details of motion.

The research team will develop and implement advanced motion planning and geometric reasoning tools for manipulator robots. A manipulator robot with a range camera mounted on its wrist will be used in experiments.

One of the team's goals is to develop an on-line, inter-active and intelligent geometric reasoning and motion planning tool kit in the form of general-purpose, stable software. This new class of robot control software will eliminate the need to teach a robot which path to follow, freeing users to program higher-level tasks instead.

Agriculture and Agri-Food Canada: Raising the Lowbush Blueberry

The Canadian blueberry industry may well grow with increased vigour when a team of researchers in Nova Scotia has completed its study of the poorly understood lowbush blueberry plant.

Professor David Percival of the Department of Biology at the Nova Scotia Agricultural College has teamed up with J. P. Prive and Peter Hicklenton, both of Agriculture and Agri-Food Canada, J. T. A. Proctor of the University of Guelph, Rob Gordon of the Nova Scotia Department of Agriculture and Marketing, as well as with the Bragg Lumber Company, the Wild Lowbush Producers Association of Nova Scotia, and the Nova Scotia Blueberry Institute to study lowbush blueberry production systems.

The lowbush blueberry requires special attention because it is unique; research and management practices useful with other species don't apply. Professor Percival plans to develop improved, environmentally friendlier and sustainable management practices by finding out about lowbush blue berry growth dynamics, nutrient uptake and distribution, water-use patterns and environmental regulation of biomass production. The team's work will likely have environmental as well as economic benefits: it should lead to a reduction in land erosion and the use of chemicals.

Canadian Forest Service: Controlling Insect Pests

Professor David B. Levin of the Centre for Environmental Health at the University of Victoria believes he may have found a natural way to manage two of Canada's major forest insect pests, the caterpillars known as eastern and western hemlock loopers.

In collaboration with Dr. Christopher Lucarotti of the Canadian Forest Service and Forest Protection Limited, Professor Levin has been studying naturally occurring nucleopolyhedroviruses (NPVs) from eastern and western hemlock looper larvae. The team believes that NPVs can be used as biological control agents.The caterpillars die when they become infected with the virus and spread of the virus through the larval population can lead to its collapse.

Dr. Levin is studying the genetic organization of the viruses, developing better ways to produce them in the laboratory, and trying to determine how much virus is needed to kill looper caterpillars in the forest.

Research Partnership Agreements:1997 Competition Results

Research Partners	No. of Requests	No. of Awards	Total Amount Requested (year 1)	Total Amount Awarded (year 1)
Canadian Forest Service			306,830	48,000
Department of National Defence	8	5	1,140,826	563,300

National Research Council of Canada	19	11	2,253,358	1,000,000
Agriculture and Agri-food Canada	30	92	1,700,000	488,692

All awards were approved by the individual partnership steering committees based on the recommendations of external reviewers and the Strategic Projects selection panels. Includes partner contribution.

* Includes one conditional award.

NAMIS Arrives With the New Year

A happy team celebrates the launch of NAMIS the brand new NSERC award management information system. Developed over three years, with the involvement of every part of the Council, the Windows-based, client-server software replaces a number of aging and incompatible mainframe-based systems. Apart from changes in some notices and forms, researchers and students won't immediately notice a great deal that is different. But behind the scenes, a new efficiency rules, with a finely-tuned, integrated system driving all NSERC's computerized competition, awards and payment processes. And it's year 2000 compatible too!

Eleven Groups Invited to Submit NCE Proposals

Eleven groups are currently hard at work preparing their Networks of Centres of Excellence (NCE) proposals. Those which are successful in the competition will share $9 million in their first year of operation.

This is the first competition for new NCEs since the federal government announced (in February 1997) its decision to make the program permanent.

Seventy-four Letters of Intent describing the proposed networks and their relevance to the objectives of the NCE program were received by the November 1, 1997 deadline. Of these, two did not meet the eligibility requirements of the NCE program and seventy-two were reviewed by a selection committee comprised of international-calibre experts with a broad base of expertise. Eleven groups were then invited to submit full NCE proposals by May 1, 1998 (see below for alphabetical list).

Under the permanent NCE program, competitions for new networks will be held every three to four years.

Network of Centres of Excellence on Biological Control (BIOCONTROL)
Contact: Raynald Laprade, Département de physique, Université de Montréal

Canadian Arthritis Network
Contact: Tony F. Cruz, Connective Tissue Research Group, Mount Sinai Hospital/University of Toronto

Canadian Institute for Photonic Innovations (CIPI)
Contacts: Michel Têtu, Centre for Optics, Photonics and Lasers, Université Laval; and William van Wijngaarden, Department of Physics and Astronomy, York University

Canadian Network for Sustainable Mining Systems
Contact: Malcolm J. Scoble, Department of Mining and Mineral Process Engineering, University of British Columbia

Canadian Stroke Network
Contact: Antoine M. Hakim, Neuroscience Research Institute, University of Ottawa

CANVAC (Developing vaccine and immuno-therapeutic strategies for the prevention and treatment of cancer and viral diseases)
Contacts: Rafick-Pierre Sékaly, Laboratory of Immunology, Institut de recherches cliniques de Montréal (IRCM), Université de Montréal; and Tak Mak, AMGEN Institute, Ontario Cancer Institute, University of Toronto

Consortium for Medical Image Science and Technology (C-MIST)
Contact: Aaron Fenster, Advanced Imaging Research Group, Robarts Research Institute, University of Western Ontario

Fisheries Network (aquaculture of fish, biodiversity of fish & capture fisheries)
Contact: Mart R. Gross, Department of Zoology, University of Toronto

Geomatics for Informed Decisions (GEOID)
Contact: Keith P. B. Thomson, Centre de recherche en géomatique, Université Laval

Mathematics of Information Technology and Complex Systems (MITACS)
Contact: Donald Dawson, The Fields Institute for Research in Mathematical Sciences, University of Toronto

Sustainable Rural Communities
Contact: Rob McLaughlin, Ontario Agriculture College, University of Guelph

For information about the Networks of Centres of Excellence program, visit the NCE Web site at http://www.nce.gc.ca.

Profiles

How to get better pictures on the tube

A research group at the University of British Columbia has devised a new way of creating sharper, clearer television pictures.

The technology that makes this possible is called image restoration. It was championed by Dr. Rabab Ward, an engineering professor at the University of British Columbia and director of their Centre for Integrated Computer Systems Research. "This is like Dolby sound for pictures," explains Dr. Ward.

She is able to get clearer pictures by running satellite or cable signals through a digital filter. This reduces the noise that can hide or distort a picture's fine details. Dr. Ward can do this image cleaning quickly, cheaply and in real time. "The result is near digital quality for a fraction of the price," says Dr. John Madden, president of Ward Laboratories Inc., a video processing spin-off company that resulted from Dr. Ward's research. "You also lengthen the life of analogue technology by making it more attractive," adds Dr. Madden.

He explains that signal noise is the main contributor to poor image quality. Removing the noise before compression results in much cleaner video images. "It's like water full of dirt and muck that clogs up the pipe system," says Dr. Madden. "If you purify it, it will flow faster and tastes better. Image restoration is like that purification."

Dr. Ward's technology could be incorporated into new television sets, TV converters and VCRs. It can also be installed at the head ends of cable providers where satellite and ground signals are received and re-transmitted to subscribers. The new technology was recently displayed publicly by Ward Laboratories Inc. for the first time at the Western Cable Show in Anaheim, California. International interest could be high, as the technology works well with all major TV standards and systems worldwide.

"All of us are used to seeing pretty crummy TV pictures," says Dr. Madden. "Unless we have a big-screen TV, most of us don't notice it." Dr. Madden says with this technology, you may soon be able to watch the Superbowl on a large-screen TV with a picture clear enough to make you feel like you're at the 50-yard line.

Dr. Ward's research was made possible through joint funding from NSERC and the Rogers Canadian Cable Labs Fund. NSERC provided a total of $243,000 over four years and Rogers gave nearly double that. "This is a concrete example of the kind of NSERC research that can affect virtually all Canadians in their day-to-day lives," says Tim Nau, director of communications for NSERC. "Everyone can see the benefit of this kind of investment in Canadian scientific research and in this case, the picture is crystal clear."

PCB eaters?

Quebec researchers are trying to turn common soil bacteria into fierce PCB destroyers.

As many as 209 compounds, or congeners, make up the infamous PCBs (polychlorinated biphenyls). Several strains of soil bacteria have been isolated that are able to at least partially break down 30 or 40 of these congeners. These soil bacteria attack the PCBs using a pathway that contains four natural enzymes.

Dr. Lindsay Eltis, assistant professor of biochemistry at Laval University, leads a team that is examining two of these enzymes. Dr. Michel Sylvestre, biotechnology professor at the Institut national de la recherche scientifique Santé, in Montreal, heads a team examining the other two. They are assisted by Dr. Justin Powlowski at Concordia University and Dr. Victor Snieckus at the University of Waterloo.

The two teams hope to discover how these enzymes enable bacteria to attack some PCB compounds but not others. After examining the enzymes, the groups plan to modify them so they'll be able to completely break down most PCB congeners.

This process of unleashing living organisms, or their products such as enzymes, onto toxic chemicals is called bioremediation. Bacteria have evolved over millions of years and have developed the ability to degrade most naturally occurring compounds. In essence, the two groups are trying to speed up this process of evolution so that bacteria can degrade compounds that have recently been made by man.

PCBs used to be used in everything from electric transformers, to ink, to cosmetics. They were banned in Canada in 1979 after studies showed high levels of cancer and miscarriages in humans who had been exposed to the pollutant, and after researchers realized how persistent and widespread PCBs really were.

Even today, many sites are still heavily contaminated with PCBs, including many harbours and Arctic regions. Dr. Sylvestre says many PCBs are hidden under sediment in our waterways and still act as pollutants, creeping up through plants on the sea floor. Traces of PCBs have also turned up in the fatty tissues of many animals. Some researchers and environmentalists assume the animals' ill health was caused by the PCBs, though it has never been proven.

"They may not be seen as such an urgent problem today," says Dr. Sylvestre, "but in 10, 20 years, they will continue disseminating and will have an even greater effect." Dr. Sylvestre explains that PCBs are very volatile and can spread to other areas over the years. He says they can get into our drinking water and food chain without much difficulty. They are also hard to get rid of. PCBs are now burned or buried, but there have been leaks. And if they are not burned at a high enough temperature, that burning can produce toxic by-products.

"But if you use natural bacteria, you don't have to transport contaminated soil or burn PCBs," saysDr. Eltis. "This would cost less

and there would be no toxic by-products ... In essence, we hope to be able to reduce pollution cleanly and affordably."

NSERC funds this collaborative research through a three-year strategic project grant for $870,000.

Dr. Sylvestre has been working on PCB degradation for over 20 years and says they've been progressing quickly thanks to NSERC funding. "I'm personally very grateful to NSERC for all their financial support," says Dr. Sylvestre. "I've been working in PCB research for many years and it's really hard to get financing." Dr. Eltis agrees: "It would have been very hard to do this kind of work in Canada without NSERC. Their funding has allowed us to compete on an international level." Bioremediation is an emerging field and there is great international interest in PCB research. The two Quebec teams are competing with research groups from the U.S., Germany and Japan. In 1995, Dr. Eltis's team, working in collaboration with Dr. Jeffrey T. Bolin at Purdue University, Indiana, came up with a 3-D model of one of their enzymes, beating a Japanese research group by just a few months. This collaboration continues and they are now working on a 3-D model of another of the enzymes. Drs. Eltis and Sylvestre have begun the next phase of their research actually modifying the enzymes so that they will attack a broader range of toxic compounds. The project runs until 1999, by which point the teams plan to have developed strains of bacteria that more effectively attack PCBs. Dr. Sylvestre predicts they will have found ways to degrade a variety of the 209 compounds in as little as six to nine months.

Biogénie, a Quebec City-based biotechnology company, will test new bacteria strains developed by the two groups.

"This research could offer all sorts of economic benefits to Canada as well as environmental benefits," says Dr. Nigel Lloyd, of NSERC. "Their success could kick-start some Canadian businesses and promote research in a fascinating and emerging field."

Dr. Sylvestre says once they can show bioremediation works on PCBs, they'll also be able to try it on other stubborn and toxic pollutants like polyaromatic hydrocarbons (PAH) or dioxins and furins. PAH is produced by fuel combustion and is often found in smog. Dioxins and furins are by-products of industrial chemical processes.

Dr. Sylvestre says one way of destroying PAH would be to put modified enzymes in car filters so the toxic by-products would be devoured before making it out into our air. He says such filters could also be put into factory smokestacks to destroy dioxins and furins. But that is a ways ahead, says Dr. Sylvestre: "First, we have to concentrate on making them eat up the more dangerous PCB compounds."

NSERC Takes Steps to Ensure It's a

Harassment-Free Workplace

NSERC recently adopted its own policy on conflict and harassment. The policy, which is based on the premise that harassment in the workplace is unacceptable, is designed to foster mutual trust, support and respect by preventing conflict and harassment when possible and by providing mechanisms for resolving conflicts early.

Approved by the Executive Committee at its meeting in January, the policy applies to all employees, including managers, indeterminate and term employees and persons seconded from other departments and agencies.

Whatever form harassment takes, whether discrimination, abuse of authority, or some other form, it is disruptive and can undermine the well-being or job performance of employees and the productivity of the organization. It is the responsibility of NSERC managers, then, to establish a milieu that's harassment-free.

To help make this happen NSERC distributed copies of the poster at left to all work areas in January. The policy applies both within the workplace and at work-related functions, such as university visits, conferences, retreats, social functions, training courses and travel.

While it is clear that this policy applies to NSERC staff only, we have posted it on our Web site. Many of the institutions we deal with have, of course, anti-harassment policies of their own that reflect the same principles. We hope these principles will also govern relations between NSERC staff and employees of other institutions.

Web Info

Committee Membership

To find out who is on a particular NSERC committee, whether it's a program-related, selection, or other committee, visit our Web page http://www.nserc.ca/comme.htm. You'll also find a form there that you can use to nominate someone you feel would make a good committee member.

Staff Directory

If you're trying to get in touch with us, you'll find this Web address handy: http://www.nserc.ca/staff/contact_e.asp. In addition to a Key Contacts listing that contains some useful e-mail addresses and the phone numbers of key staff, it also has an alphabetical listing of all staff.